

MAXIMIZE LEARNING WITH GRAPHIC ORGANIZERS

SUPPORT INSTRUCTIONAL PRINCIPLES (The big ideas)

- Identify big ideas (enduring understandings) to be taught.
- Understand the type of thinking required to process a principle.
- Select organizers that promote that type of thinking.

TEACH DEVELOPMENTALLY APPROPRIATE SKILLS

- Progress from simple to complex thought processes.
- Progress from concrete to complex abstract input for organizers.
- Progress toward individual competence in use of organizers.
- Preclude use of organizers with needed readiness activities.
- Model progressive development of language to support the thought processes.

PLAN FOR ACTIVE INVOLVEMENT OF ALL LEARNERS

- Provide structure for class, team, pair, and individual activities.
- Provide success and challenge opportunities for multilevel student populations.
- Employ strategies to raise the thinking level.

BENEFITS OF GRAPHIC ORGANIZERS

DEVELOPMENT OF HIGHER LEVEL THOUGHT

- Graphic organizers often incorporate higher-level thinking.
- Users must evaluate input and select only the most essential information since there is generally not enough room to copy directly from a source.
- Metacognitive development occurs as students explain their own thought processes and are exposed to the strategies and thinking of others.
- The format often encourages students to expand beyond the source(s): to access prior knowledge, to predict and question, to investigate further.
- Because students are often thinking at a higher level, they can more readily identify: ambiguities, the need for clarification, and information that is missing.

APPLICABILITY FOR A WIDE RANGE OF LEARNERS

- Students with very diverse levels can often collaborate meaningfully on a graphic organizer.
- More advanced learners are often challenged by graphic organizers because the format gives them an opportunity to incorporate prior knowledge and real-world applications.
- Students who did not initially know the information at the comprehension level often have the opportunity to demonstrate their intelligence when higher-order thinking is required to complete the organizer.
- Students with low literacy skills, limited fluency in the language of instruction, and those with diverse learning styles can often process information presented in this format more readily than they can traditional text material.

- Organizers are often easily modified for special needs students and English language learners.

INCREASED LANGUAGE DEVELOPMENT

- Higher-level thinking prompts more use of language.
- Students can be provided guidance in the related language of thought.
- New content vocabulary is clearly presented on the organizer.
- Students must incorporate their own words when summarizing the information presented on an organizer.

GREATER RETENTION FOR ALL LEARNERS

- People retain:
10% of what they read
20% of what they hear
30% of what they see
50% of what they see and hear
70% of what they say
90% of what they **say** as they **do** or **teach** something. (E.Dale)

When students collaborate on a graphic organizer, they are saying, doing and teaching each other.

- They are also changing written or oral input to visual input that is meaningful to them.
- People retain information more readily when they are processing it at higher levels of thought. (Examples: Students are categorizing words rather than memorizing them. Students are often reading and listening at the analytical level rather than at the comprehension level.)
- The visual presentation of any organizer reflects the relationship of the concepts, promoting greater retention for most learners.
- It is more beneficial, and more fun, to study from notes on organizers than from traditional notes.

MORE EQUITABLE ASSESSMENT MEASURES

- After using an organizer for instructional purposes, they are often very effective for assessment purposes.
- Many students, who have trouble accurately reflecting their learning on traditional forced-choice tests, can often perform well on alternative assessment measures that include graphic organizers.
- The conceptual and strategic essence of a lesson is more evident to students who study from graphic organizers.
- It is easier to make modifications for special needs students with graphic organizers used for assessment purposes than it is to modify a traditional exam.

PROGRESSIVE DEVELOPMENT IN USE OF GRAPHIC ORGANIZERS

PROGRESSION FROM THE MOST CONCRETE TO THE MOST COMPLEX APPLICATIONS	PROGRESSION TOWARD PERSONAL UNDERSTANDING AND INDEPENDENT USE
<p>Simplest to Most Challenging:</p> <ul style="list-style-type: none"> • Concrete objects • Pictures • Labels for pictures • Single familiar words • Familiar words and phrases • Familiar life application • Below grade level text with: <ul style="list-style-type: none"> ○ questions or other prompts ○ no prompts ○ use of multiple sources • Grade appropriate text with: <ul style="list-style-type: none"> ○ questions or other prompts ○ no prompts ○ use of multiple sources • Challenging life application <p>As students progress from the concrete to the abstract, in their use of any graphic organizer, they will also progress toward individual competence. See the next column.</p>	<p>Simplest to Most Challenging</p> <ul style="list-style-type: none"> • Be exposed to the graphic organizer. • Discuss purpose based on examples. • Follow directions to complete. • Interpret the information on an organizer. • Suggest categories for an organizer. • Select appropriate organizers for tasks: <ul style="list-style-type: none"> Choose from 2 dissimilar options • Choose from multiple dissimilar options • Choose best from similar options • Invent an organizer to meet a purpose. <p>To support the progression from the simplest to most challenging applications the instructional sequence would also reflect a progression from class modeling to individual applications:</p> <ul style="list-style-type: none"> • Contribute to class example. • Collaborate with group or partner. • Use independently.

SUGGESTIONS FOR DIFFERENTIATION WITH GRAPHIC ORGANIZERS

- If all students do not have literacy skills but have a wide range of oral proficiency, use the same organizer and visuals but differentiate directions for oral language or vocabulary specificity.
- Differentiate the oral language focus during development and provide diverse follow-up writing activities.
- Use the same organizer for all students but include visuals and/or resource materials with different readability levels.
- Use simple and more complex versions of organizers that meet a similar purpose: identifying attributes, categorizing information, sequencing events, identifying cause and effect, solving problems, analyzing a story, comparing and contrasting, evaluating, and so forth.
- Have some students complete an organizer with the teacher, others in teams or with a partner, some independently.
- In programs where it would be possible and appropriate, students complete the organizer in either their home language or a new language, whichever would provide both success and challenge opportunities.

COMMON PROBLEMS WITH GRAPHIC ORGANIZERS

- 1. The organizer is used to convey content but is not based on big ideas.**
 - Students use the organizer in ways that do not reflect what is most essential to know about the topic.
 - Organizational problems result that impede thinking.
 - It is difficult to use such organizers as strategic preparation for writing, research, or speaking tasks.
 - Information gaps in the materials used to complete the organizers are not evident.
- 2. The organizer does not promote the thinking required to understand the important big ideas.**
 - The organizer doesn't match the big idea. Examples include: a sequence of events when a cycle is needed, a simple web when a Venn diagram or comparison matrix is needed, a timeline to express multiple causes for one event rather than a fishbone.
 - The organizer is so similar to the presentation of the materials that students can complete the organizer without understanding the ideas.
 - The organizer is functional, but a different one, still developmentally appropriate, would evoke more thought.
- 3. The organizer is not developmentally appropriate for the range of learners.**
 - The organizer is cognitively either too simple or too complex.
 - The organizer does not match the motor skills of the students, for example, too small for emergent writers.
 - The organizer is not used in a meaningful context where students have either prior knowledge or comprehensible access to the content and vocabulary.
 - The readability level needed to complete the organizer is either too difficult or not challenging, and no developmentally appropriate alternative resources are provided.

- While developmentally appropriate for some students, no alternative organizers that meet the same purpose are provided for students who would benefit from a simpler or more complex version. Some students may benefit from a completely different organizer that focuses on simpler or more challenging related ideas.
 - Some students will finish before others, and no challenge option is included in the assignment. Challenge examples include: rank the items on a web diagram based on some aspect of comparison, rank some aspects of comparison on a comparison matrix, complete a challenge option on an organizer, use more complex resources to add additional information to the organizer, use sentence prompts related to the thought process reflected on the organizer to express the important relationships, illustrate or draw symbols for the most important vocabulary or information, and prepare to role-play important relationships on the organizer. It is important that students who try the challenge have opportunities to share those tasks with the class.
- 4. There is not enough modeling prior to the degree of student accountability required.**
- Class modeling does not precede team or partner use; and/or team or partner use does not precede individual use.
 - Modeling does not include how to interpret completed organizers prior to independent use of them. Reading or interpreting completed organizers helps students understand the thought processes for creating them.
 - Cooperative structures for asking questions are not used during class modeling, so some students, unfortunately often those who most need the guidance, are not actively engaged.
 - Not enough structure is provided for individual accountability during team or partner use; consequently, the lowest performing students are often less involved during the guided practice that is so critical for them.
 - Students do not get enough varied experiences with a graphic organizer, preferably across disciplines, prior to individual accountability for applications not modeled.
- 5. There are problems with the format of the organizer.**
- The organizer is in a pictorial format that impedes rather than helps comprehension.
 - The writing space is either too small for the information needed, or too much space is provided and students can just copy text rather than selecting the most important information.
 - Students are asked to make their own organizers which may result in: too much educational time required for the task, ineffective use of the space provided, or sloppy organizers that impede learning (usually made by the student with the poorest fine motor skills who is the most dependent on a neat organizer).
- 6. Inadequate support is provided to express the information and relationships conveyed on the organizer as well as retain and expand on the learning.**
- Students complete a graphic organizer, but no follow-up discussion and/or reading and writing tasks are given. A common example is having students complete a comparison matrix without ever orally discussing or writing about the comparisons.
 - Once the organizer is complete, students may be assigned follow-up tasks without adequate modeling. Modeling examples include: oral and written language prompts to express the thought processes reflected by the organizer as well as examples of how people use organizers to prepare for oral presentations and write related sentences, paragraphs, or longer written forms.

- There is insufficient review and expansion related to the vocabulary and ideas to aide retention.
- Students receive minimal guidance in how to use the organizers to prepare for tests.
- Students are not exposed to ways the organizer is used outside of the classroom.

7. There are management problems during use of the organizer in class.

- Student expectations are not clearly communicated, and a pattern for orderly behavior and respect for each other and the learning process has not been established.
- Directions are not clearly communicated. Of course, confusion is less of a problem with adequate modeling.
- The grouping arrangements do not maximize learning opportunities.
 - i. Too many students are expected to use one organizer. This is particularly problematic if four or more students are collaborating on the same sections of an organizer requiring all students to read or write the same text.
 - ii. The academic or proficiency levels of the partners/team members are not the most effective given the student population and the assigned task. For example, pairing of a very top student with a student who needs a great deal of support may result in tutoring rather than cooperative learning. Language proficiency is also a variable. A student with limited language proficiency needed for a task, may benefit from native language support, while a student with more language skills may benefit from working with a partner in the new language. Two timid students may benefit from working with each other, and so forth.
- Class time is not used wisely. Examples include: giving directions and distributing materials takes too long, there is too little time or too much time to do the task, or students are not told how much time they will have.
- Students are not on task during class, team, partner or individual use. These are less of a problem if:
 - i. cooperative structures are used to ask questions during class modeling,
 - ii. individual accountability is clearly defined in team and partner tasks,
 - iii. the tasks are developmentally appropriate for the range of learners,
 - iv. there are challenge options for those who finish early, and
 - v. the students who have time for the challenge are accountable to classmates rather than the teacher

21 SUGGESTIONS FOR RAISING THE THINKING LEVEL WHEN USING GRAPHIC ORGANIZERS

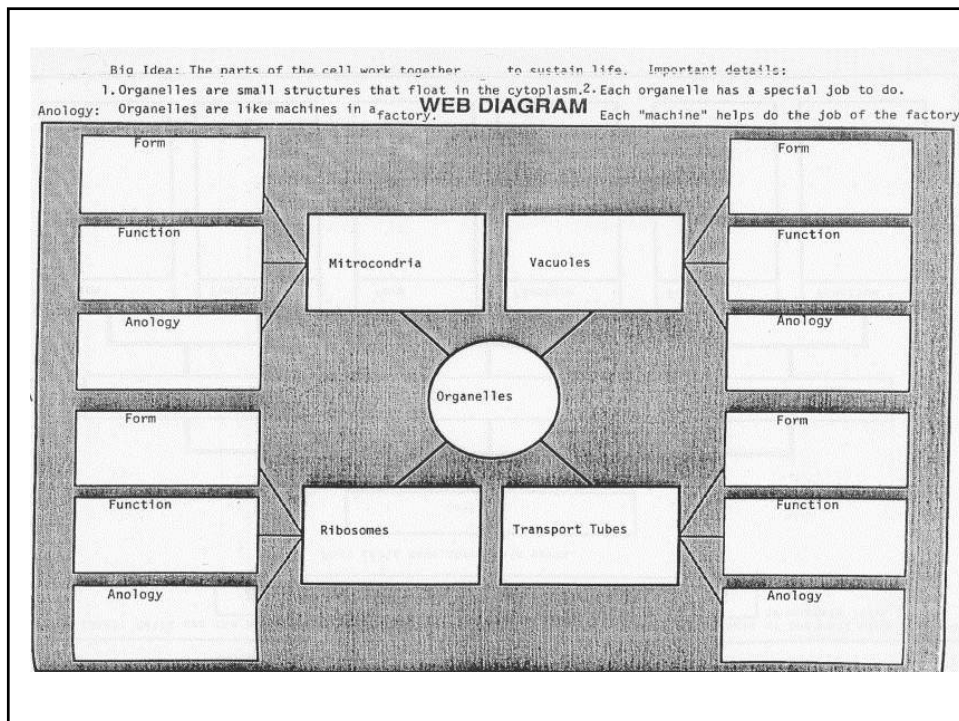
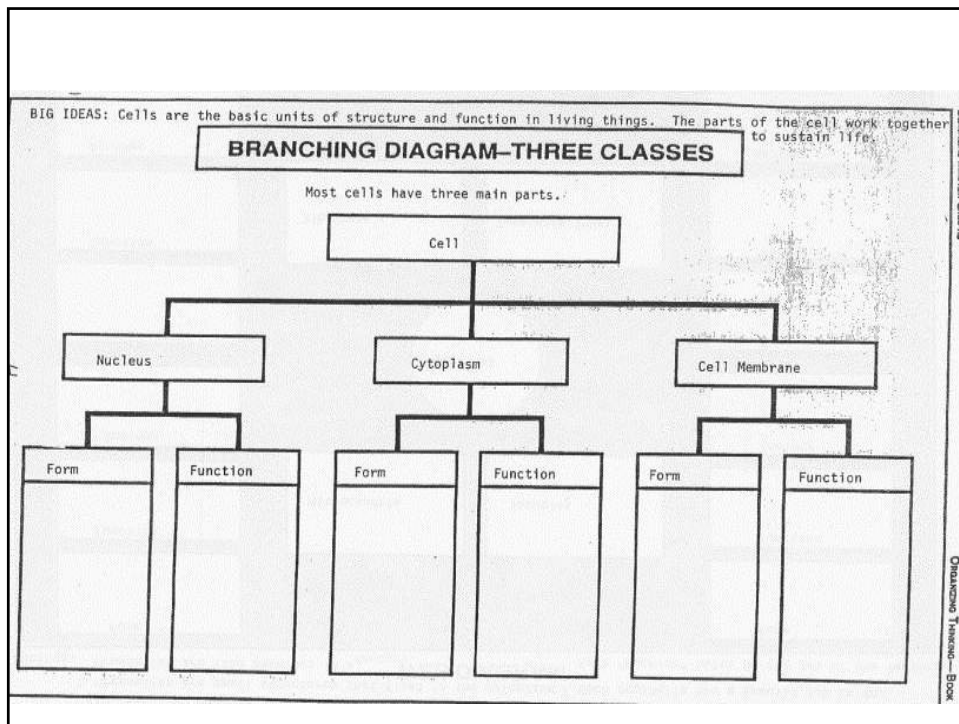
1. Use organizers that match a big idea and write the idea on the organizer.
2. When more than one organizer is appropriate, choose the one that evokes the most thought (or) give a simpler one for homework or individual work and a more complex one for team follow-up discussion (or) use organizers that meet the same purpose with different levels of complexity for the range of learners.
3. Use differentiation strategies suggested above.

HAVE STUDENTS DO THE FOLLOWING KINDS OF TASKS:

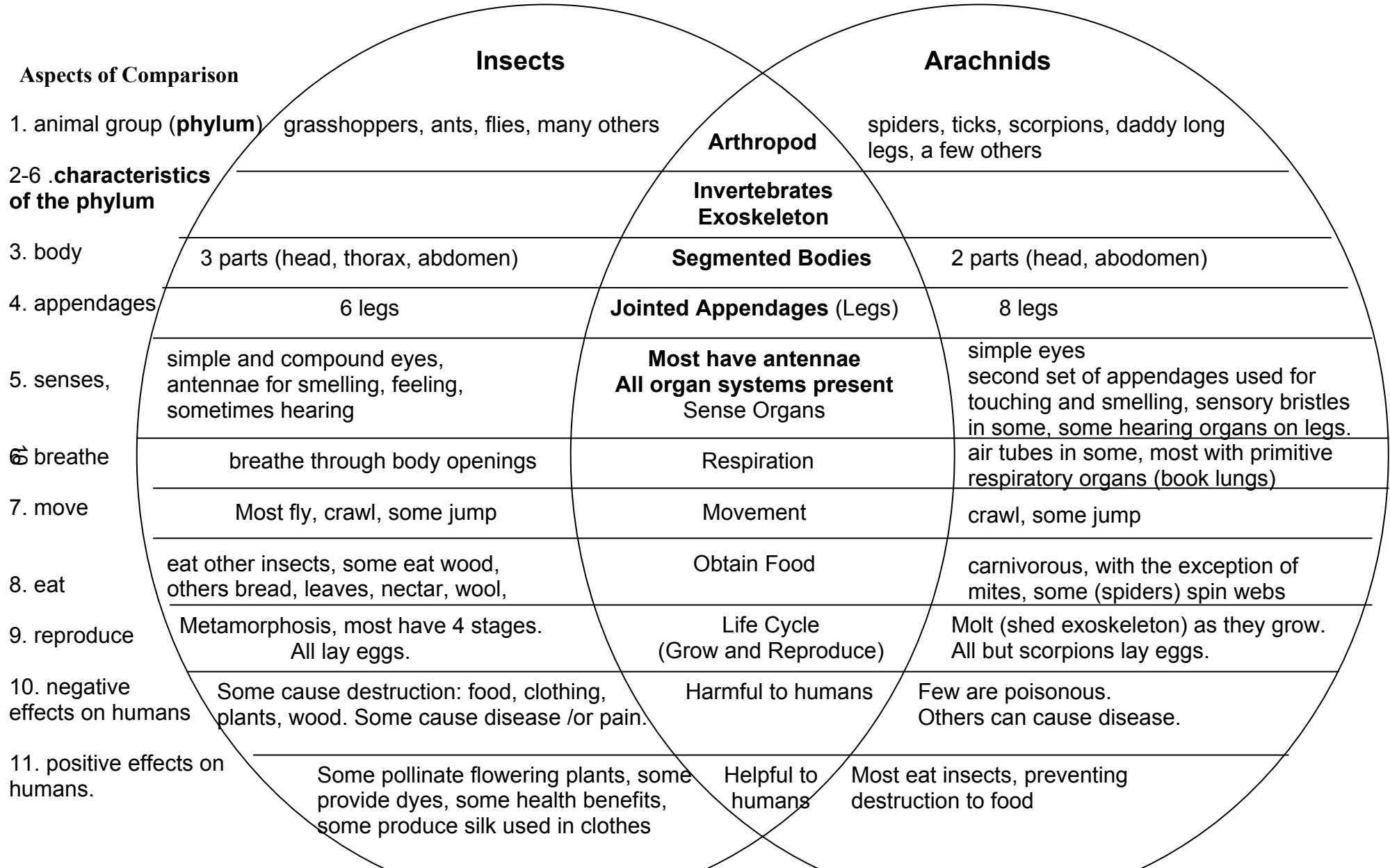
4. Write a statement expressing the essence of the information on an organizer (if the big idea is not provided by the instructor on the organizer).
5. Highlight the most important words on an organizer.
6. Draw symbols for confusing terms or the most important information.
7. Color-code information on an organizer and make a key.
8. Given a limited number of options on an organizer, select the most important information to include.
9. Rank the information on an organizer from the most to the least of a specified aspect.
10. Evaluate information as being positive, negative, or neutral.
11. Repeat ranking (or) positive/negative/neutral evaluations from a different perspective. Use the information on a simple graphic organizer as a springboard for completing a more complex one.
12. Use the reading strategy of Connect Two (PU) to identify and explain connections among key terms on an organizer.
13. Use sentence prompts to demonstrate sentence variety when expressing similar ideas or relationships on an organizer.
14. Following a Word Sort (PU) record the terms used in the sort onto an organizer. Add any needed terms.
15. Complete a section of an organizer or answer related questions that require drawing inferences, activating prior knowledge, and/or making predictions.
16. Create a role-play to represent information on an organizer.
17. Given a completed organizer prior to reading, discuss and predict textual information.
18. Given information for a blank organizer, predict placement on the organizer, read (or listen to a lecture) to check predictions and make corrections.
19. Given a task, select the most appropriate organizer from options and support the choice by explaining your rationale.
20. Design your own organizer to effectively represent information.
21. Compare your organizer with that of others and collaborate to evaluate the effectiveness of each.

TEN POINT CHECKLIST OF QUESTIONS WHEN USING GRAPHIC ORGANIZERS

1. Does the organizer have a strong educational purpose? Does it promote attainment of school outcomes?
2. Does the organizer chosen match the thinking required for the big idea(s) being taught?
3. Would an alternative organizer promote more thought?
4. Do the students have the experiential and conceptual readiness required for the organizer?
5. Is the organizer at the appropriate level in the progressive development of needed skills?
6. Are there ways to increase thought with the organizer selected?
7. Will students collaborate on the organizer? If so, ask the following:
 - How will you structure involvement of all learners?
 - How will you increase language during the interaction?
 - Do you need a social skill focus?
 - What is the challenge activity for students who finish before others?
8. Is the organizer appropriate for a heterogeneous group of students, or can it be easily modified to include a wide range of learners?
9. How will students summarize, orally and/or in written form, the information presented on the organizer? Do they have the language needed to effectively communicate the information? If not, how will you teach the language for the thought processes reflected on the organizer?
10. Would the organizer be an effective alternative form of assessment? If so, how will it be used?



BIG IDEA: Insects and Arachnids have many similarities but differ in important ways. BIGGER IDEAS: Animals are classified based on common characteristics. Features and behaviors of animals help them meet their needs. Animals have a life cycle and reproduce to maintain their species. Some animals are both beneficial and harmful to humans.



LANGUAGE SAMPLES FOR COMPARING AND CONTRASTING

DIRECTIONS: Use some of the sentence prompts to demonstrate sentence variety when comparing and contrasting.

CHALLENGE: After writing each similarity, write the differences for that aspect of comparison rather than writing all of the similarities and then all of the differences.

SIMILARITIES

EXAMPLES:

1. Insects and arachnids are **alike** in many ways.
2. The **most important similarity** is that they are **both** arthropods.
3. **Like all** arthropods, they are invertebrates.
4. Insects, like arachnids, have an exoskeleton, a hard body covering.

CHOOSE FROM THE SENTENCE OPTIONS TO WRITE MORE SIMILARITIES

5. **Both** animals have the **same kind of** _____.
6. A **similarity** between the two animals is _____.
7. A **common characteristic** of arachnids and insects is that they _____.
8. **Both** animals **share** (have) the ability to _____.
9. Eating (use any verb that fits) _____ is **common** for both arachnids and insects.
10. **In addition to** _____, **both** animals _____.
11. **Their** appearance (habitat) is **similar** in many ways.
12. **Similar to** insects, arachnids _____.
13. **Each** animal _____.
14. **A commonality between** these two animals is the way they _____.
15. Insects have _____ **which is similar to** (identical to, like) that of arachnids.
16. Being primarily _____ animals, **each** _____.
17. The practice of eating (any action) _____ is **similar to each** (common to both).

18. Arachnids and insects are **representative of all members of** the _____.
19. Arachnids' _____, **similar to that of** insects, _____.
20. Insects and arachnids **have the same (belong to the same, are from the same)** _____.
21. **Common** needs are met in **similar** ways.
22. **Sharing a common** _____, both insects and arachnids _____.
23. Arachnids _____, **similarly**, insects _____.
24. Insects are **as** _____ **as** arachnids.
25. **Neither** insects _____ **nor** arachnids.

DIFFERENCES

CHOOSE FROM THE SENTENCE OPTIONS TO EXPRESS THE DIFFERENCES.

1. Insects and arachnids are alike in many ways; however, there are some important **differences**.
2. The most striking **difference between** the two animals is _____. Insects _____, but arachnids _____.
3. _____ is another critical difference. While insects _____, arachnids _____.
4. Insects are **more** _____ **than** arachnids.
5. Most insects can _____ but arachnids can't.
6. Arachnids, **unlike** insects, _____.
7. _____ is another **difference between** the two animals.
8. Insects _____, **conversely**, arachnids _____.
9. Insects _____, **whereas** arachnids _____.
10. **Although** arachnids _____, insects _____.
11. **Unlike** insects, arachnids _____.
12. Insects _____. **On the other hand** arachnids _____.
13. _____, a characteristic of some arachnids, is **not present** among insects.

14. **While** arachnids _____, insects _____.
15. The insects' habit of _____ is **not a characteristic of** arachnids.
16. Insects _____, **in contrast**, arachnids _____.
17. **In contrast to** insects, arachnids _____.
18. **Compared to** arachnids, insects are more _____.
19. It is **not common** for arachnids to _____, **but** insects _____.
20. The _____ of insects is **distinct from** _____ of arachnids.
21. The way insects obtain food **differs from** arachnids _____.
22. _____ is **more** difficult for insects **than** it is for arachnids.

CHALLENGE TASKS AFTER CLASS MODELING:

Write a paragraph comparing and contrasting one type of insect with one type of arachnid.

GREATER CHALLENGE

Write an essay comparing and contrasting two similar animals of a specific animal class, family, or biome. Demonstrate correct use of specific comparative vocabulary and incorporate sentence variety into the comparative essay. In the first paragraph introduce the animals to be compared, state the most important similarity and difference and summarize the aspects of comparison. In the following paragraphs, write the similarity and the related difference for each aspect of comparison. Write a summary paragraph restating the most important information.

ELEMENTS, MIXTURES AND COMPOUNDS COMPARISON MATRIX

	Atoms	How combined	Properties	Proportion	How separated	Important information
Element	Substance made of only 1 kind of atom.	Chemically combined. Bond with the same atoms. Ex. 1 oxygen and 1 oxygen bond = 1 oxygen molecule. No matter how many together, still oxygen.	Physical properties and chemical properties stay the same. Ex. The properties of oxygen stay the same.	Just combines with itself, so same proportion. (If the bond breaks and it combines with something else, it becomes a compound.)	Bonds can be separated chemically, but if they combine with other kinds of atoms, they become a compound.	Elements are identified on the periodic table. Everything is made up of the elements, either by themselves or combined with mixtures or combined with other elements to make compounds.
Mixture	More than one kind of atom. Can be a mixture of both elements and compounds.	Different substances just mixed up. Not chemically combined, no new substance.	Physical properties can stay the same or change. Ex. Shake a bottle of Italian salad dressing, and it changes.	Can combine in any proportion. Ex. Mix salt and water in glass. Can put in different amounts of salt.	Can be separated physically into pure compound or elements. Ex. Evaporate salt water. Water vapor is in the air. Salt stays in the glass. Can be mechanically separated.	Most natural substances are mixtures.
Compound	More than one kind of atom. Consequently, made of at least two elements.	Combine chemically, forming new molecules. Bonds between atoms break. New bonds form. Become a new substance.	Different than the properties of the elements that are combined to make them. Become a new substance.	Combine in set proportions. Ex, 2 hydrogen molecules and 1 oxygen molecule. = 1 water molecule, a new substance.	Bonds are separated chemically. Different things cause the bonds to break. For example, heat can cause the bonds to break.	Some compounds can occur quickly, some over time. For example paper burns quickly. It is no longer paper. Iron rusts slowly. The rust is no longer iron. It is a new substance.

DIRECTIONS: Use the information in the comparison matrix on Elements, Compounds, and Mixtures to complete the sentences below.

1. Elements are made of _____, but compounds
_____.

2. Both elements and compounds combine _____:
however, mixtures _____

(Two possible answers)

3. Unlike the properties of elements _____,
the properties of compounds _____

4. Elements and compounds are both separated _____.
In contrast, mixtures _____.

How the Body Fights Disease

BIG IDEA: The body has defense mechanisms that help prevent illness.

Body feature	Where is it?	What does it look like? Draw or describe.	How does it protect?	CHALLENGE Read a harder passage to tell more about how each protects:
Skin				skin
Saliva				Digestive System
Mucus				Respiratory System
Immune system				white blood cells and antibodies

CHALLENGE: When finished, prepare to role-play one of the defense systems of the body.

CELL TYPES

BIG IDEAS: Body cells work together to sustain life. There are different kinds of cells, each with a special job.

NAME	Function of Cells	Shape of cells & location	Why function is important	How cells perform function

CHALLENGE: Use sentence prompts to express why and how cells perform their functions: Sequential action, simultaneous action, conditions, and cause-effect.

Or use sentence prompts to compare and contrast the cells.

FOUR KINDS OF MOUNTAINS

BIG IDEA: The earth's moving plates cause mountains to form in different ways.

MOUNTAIN	# Plates	Cause	Effect	Picture
Fold Mountains				
Block Mountains				
Dome Mountains				
Volcanoes				

DIRECTIONS: Use the cooperative structure of Within-Team Jigsaw to complete the comparison matrix.
CHALLENGE: Use cause-effect sentence prompts to write the cause-effect relationships in different ways.

COMPARISON OF WEATHER DATA AND WEATHER INSTRUMENTS

WEATHER DATAe	WEATHER INSTRUMENT	UNIT OF MEASUREMENT	DESIGN (HOW IT'S MADE)	CHALLENGE What is the scientific principal that influences the design?
temperature				
air pressure				
wind speed				
relative humidity				

DIRECTIONS: Use Within-team Jigsaw to complete the matrix.

CHALLENGE: Read more complex information to answer the final column.

After each team member teaches his/her row, collaborate to complete the final column.

COMPARISON OF ENERGY SOURCES

BIG IDEA: There are multiple sources of energy each with advantages and disadvantages.

Source	Description	Uses	Obtain by....	Renewability	Cost	Dangers
Oil						
Coal						
Nuclear Fission						
Solar Energy						

DIRECTIONS: Use Team Jigsaw to teach the information about your assigned energy source.

CHALLENGE: Use sentence prompts to compare and contrast the energy sources based on the aspects of comparison.

SUPER CHALLENGE: Rate the last four columns. Hardest to obtain to easiest, takes the longest time to renew to the shortest time, costs the most to costs the least, is the most dangerous to the least dangerous to workers and/or consumers. 4 is most, 1 least.

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SENTENCE PROMPTS FOR COMPARING SIMILARITIES

_____ and _____ are alike in many ways.

Both _____ and _____.

_____, like _____,

_____ and _____ the same _____

Both _____ share _____.

_____ as _____ as _____.
(is, are) (adjective: tall, old, etc.)

A common characteristic of each is _____.

Like _____,

_____, similar to _____,

_____, and so _____.

Neither _____ nor _____.

Each _____ a similar _____.

_____, likewise _____.

Perhaps the most significant similarity is _____.

SENTENCE PROMPTS FOR CONTRASTING DIFFERENCES

_____ and _____ are different in many ways.

_____, but _____.

_____ ; however, _____.

_____ er than _____
(is,are) (adjective: taller, older, etc.)

_____ not as _____ as _____
(is, are) (adjective, tall, old, etc.)

_____ more _____ than _____
(is,are) (adjective: beautiful, dangerous etc.)

_____ less _____ than _____
(is,are) (adjective: helpful, interesting etc.)

While _____,

_____, yet _____.

_____ ; conversely, _____.

In contrast to _____,

_____, in contrast, _____.

It is not common for _____ to _____ ; however, _____.

Unlike _____ that _____,

An important difference between _____ and _____.

COMPLEX SENTENCES TO EXPRESS SEQUENTIAL ACTION

Before _____, _____.

After _____, _____.

_____ before _____.

_____ after _____.

When _____, _____.

_____ when _____.

COMPLEX SENTENCES TO EXPRESS SIMULTANEOUS ACTION

When _____, _____.

_____ when _____.

As _____, _____.

_____ as _____.

While _____, _____.

_____ while _____.

SENTENCE PROMPTS TO EXPRESS CAUSE AND EFFECT

_____, so _____.

_____ because _____.

Because _____, _____.

Since _____, _____.

_____ since _____.

_____ ; consequently, _____.

_____ ; therefore, _____.

_____ causing _____.

_____ which causes (caused) _____.

_____ resulting in _____.

_____ which results (resulted) in _____.

_____ affects (affected) _____.

Now that _____, _____.

COMPLEX SENTENCES TO EXPRESS CONDITIONS

If _____, _____.

_____ if _____.

Unless _____, _____.

_____ unless _____.

Only if _____.

_____ only if _____.

If the particular condition doesn't matter, the result will be the same, use the following:

Even if _____, _____.

_____ whether or not _____.

Use the following when something probably won't happen in the future, but it might.

In case _____.

_____ in case _____.

In the event that _____.

_____ in the event that _____.



Middle School Problem-Based Lab Rubric

Student Name _____

Teacher Name _____

Lab Title _____

Date _____

Category	4 Exceeding Standards	3 Meeting Standards	2 Approaching Standards	1 Not Meeting Standards	Self Reflection	Peer Reflection	Teacher Reflection
<i>Introduction</i> Topic Purpose Problem	The topic, purpose, and problem are related to each other. The lab problem is clearly testable.	The main purpose of the lab is clear and the problem can be tested.	The main purpose or problem of the lab is unclear.	The purpose and problem of the lab are unclear or miscommunicated to reader.			
<i>Research</i> Variables Hypothesis	Specific research is used to support the hypothesis and it clearly corresponds with the purpose and problem. Hypothesis is stated as an "If..then..because.." statement and accurately identifies the independent and dependent variables.	The hypothesis is partially supported by research of the topic. The proper variables have been identified and incorporated into the hypothesis.	Some research has been documented; however, it is not used to support the hypothesis or a mistake was made in identifying the variables.	Research is unrelated to topic or the hypothesis does not show a relationship. Variables not mentioned or incorrectly identified.			
<i>Plan</i> Procedure Data Table	The plan is sequential, logical, repeatable, and contains safety procedures. All variables are accounted for within the steps and are able to be collected using scientific measurements. The data table is set up to collect a minimum of 5 measurable pieces of data and includes a title and appropriate labels.	A logical plan including safety procedures is created that another scientist could easily repeat. All variables are identified. Steps have been made to appropriately control the environment and to collect a minimum of 3 measurable pieces of data. All important data has a place in the data table.	The plan is logical but doesn't contain all of the environmental controls or safety procedures necessary for a scientist to repeat. Most variables are identified and have a place on the data table.	The plan is not designed to find the answer to the identified problem or does not follow a sequence of events that could be repeated. Safety has not been considered in the procedure. The data table has not been set up to collect appropriate data. The variables are not sufficiently identified.			

Category	4	3	2	1	Self Reflection	Peer Reflection	Teacher Reflection
<i>Results</i> Data Graph Data Summary	A minimum of 5 measurable pieces of data have accurately been collected and displayed. The graph visually displays the answer to the lab problem. There is a clear, concise data summary.	Data shows reasonable trends and patterns (minimum of 3 measurable pieces of data). The graph displays the answer to the lab problem. A data summary paragraph is accurately included but not concise.	Data is incomplete or inconclusive. Unreasonable patterns were shown on data table or graph or the data summary is lacking a connection to the problem.	Important data is missing or not organized appropriately. Graph does not show significant findings of this lab experience.			
<i>Understandings</i> Data Analysis Conclusion in CEI Format	The analysis and conclusion demonstrate a complete understanding of the purpose of the lab, the results, interpretation into everyday life, and future investigations are identified. An exemplary conclusion is linked to the problem and hypothesis and is written in a CEI format (Claim, Evidence, and Interpretation).	Analysis supports results of lab. A satisfactory conclusion is written in a CEI format (Claim, Evidence, and Interpretation).	The analysis is incomplete or is not based on findings. The conclusion does not address the research problem or does not use data to provide evidence for the claim.	Analysis and conclusion are not related to findings in the lab or the research. Complete thoughts were not used to convey ideas.			
<i>Format</i> Overall Appearance And Accuracy	Lab report is organized according to lab rubric, neat, and shows attention to detail with no grammatical errors.	Lab report is organized according to lab rubric, neat, and has few grammatical errors.	Lab report lacks organization and does not follow the order of the lab rubric. There are some grammatical errors.	Lab report is disorganized, incomplete, with little attention to detail. There are several grammatical errors.			
TOTAL SCORE = 24							



Problem-Based Lab Template

Name _____

Date _____

Lab Title _____

Teacher _____

INTRODUCTION:

Topic: The main scientific idea this lab is about.

Purpose: The reason you are doing the lab investigation.

Problem: The problem should be: unknown, testable, and in the form of a question.

RESEARCH:

Provide at least two pieces of relevant information as well as the source. A source can be a teacher, class notes, text, etc.

Source 1: _____

Information Found:

Source 2: _____

Information Found:

Identify Variables: These three variables must be included in your procedure.

One Independent Variable

The factor you purposely manipulate

One Dependent Variable

The measurable result you are looking for

Four Controlled Variables

The factors you keep exactly the same in all parts of the lab.

1) _____

2) _____

3) _____

4) _____

Hypothesis: Your educated guess to answer the problem based on the facts from the research.

If (*change in independent variable*)

then (*predicted change in dependent variable*)

because (*a piece of research you cited*)



Teacher/Peer check of INTRODUCTION and RESEARCH

THE PLAN:

Procedure: Step by step instructions on how to do your lab including safety precautions and all variables. The steps of the procedure should be very specific.

1)	
2)	
3)	
4)	
5)	
6)	
7)	
8)	
9)	

Use additional paper if necessary

Data: The information you collect during the experiment

Title: _____

Independent Variable: _____	Dependent Variable: _____				Units: _____
Units: _____					

☐

Teacher/Peer check of THE PLAN

RESULTS:

1. Fill in data table with collected data.
2. Create a graph representing your data on a separate sheet of graph paper.

Data Summary:

☐

Teacher/Peer check of RESULTS

UNDERSTANDINGS:

Data Analysis: Discuss your findings. Include such things as: sources of error, trends in data, limitations of the study, and application of the findings.

[illegible]

CONCLUSION:

Claim: State the connection between the data collected and the hypothesis or purpose of the lab.

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Evidence & Elaboration: Provide specific data that supports the claim and explain how it supports the claim.

<p style="text-align: center;"><u>Evidence 1:</u></p> <hr/> <hr/> <hr/> <hr/> <hr/>
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<p style="text-align: center;"><u>Evidence 2:</u></p> <hr/> <hr/> <hr/> <hr/> <hr/>
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Interpretation: Connect a concept learned in class to the lab experience and make a connection to use beyond the classroom. You may also include sources of error and/or extensions or improvements to the lab.

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STUDENT check of ENTIRE LAB (using rubric)